CANADIAN

ARCHITECT AND BUILDER

VOL. XVI.

1903 :
THE C. H. MORTIMER PUBLISHING COMPANY OF TORONTO, LIMITED.
TORONTO, CANADA.

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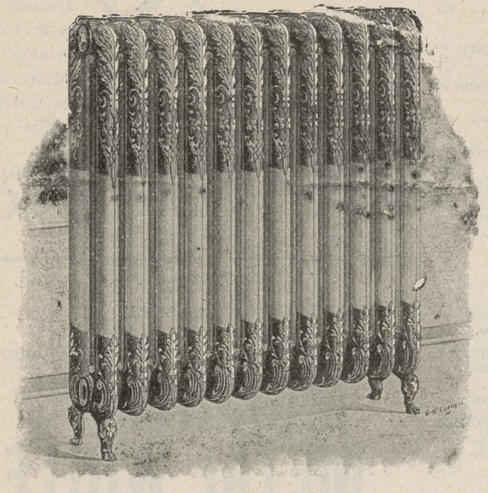

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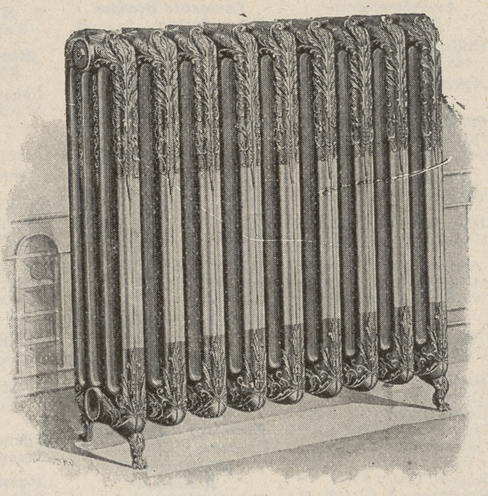

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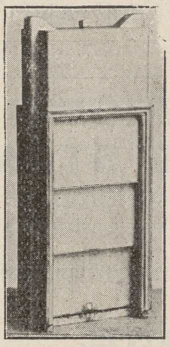

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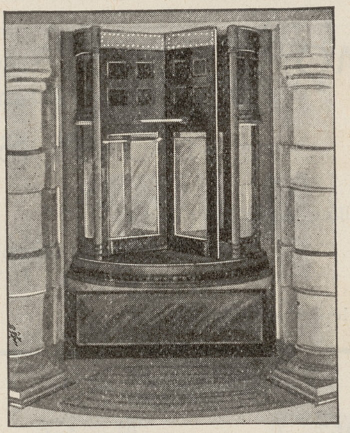

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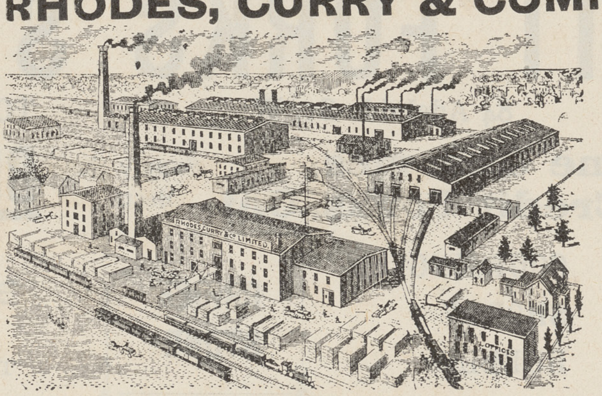

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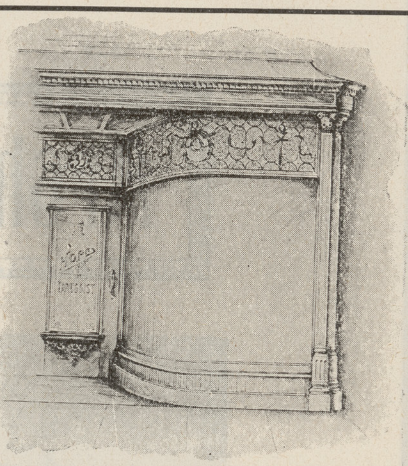

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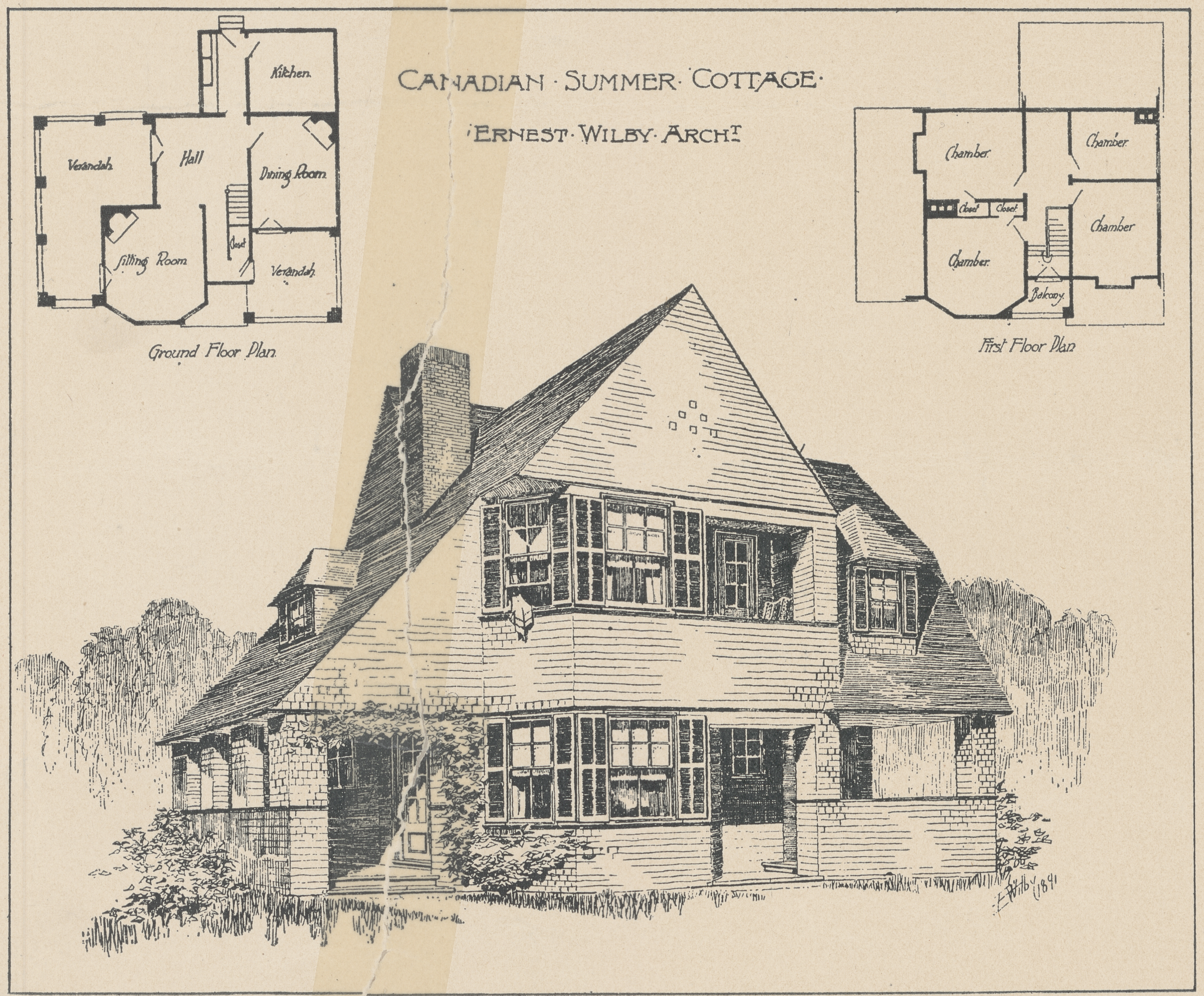
JANUARY, 1903



FROM THE BUILDING NEWS

DESIGN FOR A SUMMER COTTAGE.
ERNEST WILBY, ARCHITECT.

The Canadian Architect and Builder

VOL. XVI.—NO. 181. JANUARY, 1903.

ILLUSTRATIONS ON SHEETS.

House on Park Road, Toronto.—Burke & Horwood, Architects.
Design for a Canadian Summer Cottage—Ernest Wilby, Architect.

ILLUSTRATIONS IN TEXT.

Ornamental Portico and Grill at the Residence of the Hon. Geo. A. Cox, Toronto.—G. M. Miller & Co., Architects.

ADDITIONAL ILLUSTRATIONS IN ARCHITECTS' EDITION.

Photogravure Plate—Certosa di Pivia—Detail of Facade and Interior Doorway.
Photogravure Plate—Monuments of Guigelmo da Castel Barco, the Friends and Advisers of the Scaligers, Verona, Italy.
Stained Glass—By T. W. Camm, Smethwick, Eng.
Guardian Life Assurance Company's Building, St. James Street, Montreal.—Finley & Spence, Architects.

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SPECIAL CONTRIBUTORS.

PROF. S. H. CAPPER, R.C.A., Department of Architecture, McGill University, Montreal
MR. W. A. LANGTON, Architect, Toronto.
" EDMUND BURKE, " "
" S. H. TOWNSEND, " "
" FREDERICK G. TODD, Landscape Architect, Montreal
" W. H. ELLIOTT, Toronto.
" J. C. B. HORWOOD, Architect, Toronto.
" A. F. DUNLOP, R.C.A., Architect, Montreal.
" FRED. T. HODGSON, Architect, Collingwood, Ont.

Prevention of Rust in Steel Construction.

From recent experiments conducted by Prof. Charles L. Norton at the newly established Insurance Engineering Experiment Station in Boston, to determine means of preventing the corrosion of steel frames used in building construction, the following conclusions have been reached :— First : Neat Portland cement, even in thin layers, is an effective preventive of rusting. Second : Concretes, to be effective in preventing rust, must be dense and without voids or cracks. They should be mixed quite wet where applied to the metal. Third: The corrosion found in cinder concrete is mainly due to the iron oxide, or rust, in the cinders and not to the sulphur. Fourth: Cinder concrete, if free from voids and well rammed when wet, is about as effective as stone concrete in protecting steel. Fifth: It is of the utmost importance that the steel be clean when bedded in concrete. Scraping, pickling, a sand blast and lime should be used, if necessary, to have the metal clean when built into a wall.

The O. A. A.

THE papers and discussions formed the principal feature of the annual convention of the Ontario Association of Architects held in Toronto last week. The papers covered a wide range of subjects, from decoration to modern methods of steel and fireproof construction. They were ably treated by the authors and evoked lengthy discussions, in the course of which much additional information was elicited. The unusually large attendance at the sessions indicates that a programme of this character commands the attention of members of the profession who cannot but feel that to stay away from the convention is to miss gaining information of great value in everyday practice. In the present number will be found papers by Mr. Gustave Hahn on "Color in Decoration," and by Mr. E.C. Shankland, C.E., of Chicago, on "Modern Constructive Methods" with the accompanying discussions. In our February number will appear the remaining papers by Prof. Shortt, of Queen's University, on "Architecture as a Social Art," and by Prof. William L. Rice, of Philadelphia, on "Design," with the discussions thereupon.

Cement Production and Demand.

A recent article in The Monetary Times declared that the production of Portland cement in Canada next year would largely exceed the demands of the market. The estimated production for the year was placed at $1,515,000 barrels, which we believe will be found to be an overstatement. While it may not be out of place to speak a word of caution to promoters of new cement manufacturing enterprises, our manufacturing facilities in this line are no more than sufficient, if indeed they are adequate to supply the demand in the Canadian market, which demand is rapidly growing. With the growth of population in

the north and west, the multiplication of industries in which cement is employed and the many new uses to which the material is being applied, there is no doubt still room for a considerable development of the industry. After the home demand shall have been met there will remain foreign markets to be exploited. There is no reason why Canadian cement manufacturers should not be successful in securing their share of foreign orders, as manufacturers in other lines are doing. The demand for cement is said to be rapidly increasing in the Spanish-American countries, as the result of the inauguration of extensive public works. No cement is manufactured in these countries, 95 per cent. of the demand being supplied by Hamburg and the remaining 5 per cent. from England. The French Commercial Adviser recently suggested that a group of French manufacturers of cement and mosaic tiles should form a syndicate and appoint five energetic representatives, who speak Spanish and are acquainted with the customs of the countries. They should be supplied with samples and visit the principal Latin-American towns with the object of obtaining government and municipal contracts. These representatives should be apportioned, as follows :—1. Mexico and Central America, Cuba and Porto Rico. 2. Venezuela, Colombia, Guiana and the lesser Antilles. 4. Argentina and Uruguay. 5. Brazil and Paraguay.

OUR BRITISH TRADE SUPPLEMENT.

A new feature appears in this number, in the form of a British Trade Supplement containing the announcements of a number of representative British firms engaged in the manufacture and sale of various materials for the use of architects and contractors. These British firms desire to introduce their goods in Canada, under the terms of the preferential tariff, and to obtain competent and reliable persons to act as their representatives in this country. The well-known reliability of British manufactured goods, and the desirability of closer trade relations with the mother country, should prompt Canadian architects and contractors to carefully examine the announcements appearing in our British Trade Supplement, to open correspondence with the various firms represented therein, and make fair trial of the goods offered. The publishers of the CANADIAN ARCHITECT AND BUILDER will be pleased to supply from their offices in Toronto and Montreal catalogues and information in behalf of these enterprising British firms.

C. A. & B. STUDENTS COMPETITION.

Thirteen sets of drawings have been received in our Students' Competition for designs for a $2,500 Town or Suburban House. The drawings are now in the hands of the Committee of Award representing the Ontario Association of Architects and the Toronto Architectural Eighteen Club. On account of the annual convention of the former and the annual exhibition of the latter in progress at present, it was found impossible to have the designs considered in time for the result to be announced in this number. The Committee's report, with perhaps one or more of the successful designs, will be published in February. Meanwhile we wish to express our appreciation of the manner in which the Students have responded to our invitation to enter this Competition. It will encourage us to announce others from time to time in the future.

ARCHITECTURAL LEAGUE EXHIBITION.

The Eighteen Club's display of photographs and prints, which constitute the circuit exhibition of the Architectural League of America, is of moderate interest. The most satisfactory work shown is in the collection of prints of English work, which are however very small and usually show no more than a distant perspective view of the parish churches which they represent. As English work, following English tradition, and suiting English taste and English church worship, these are admirable. An old English church or a modern English church may be, and are, of the same family, and the one seems as appropriate as the other. Mr. Cram, whose opinion given in his lecture before the Eighteen Club at the gallery on Jan. 17th, was courageously in favor of the same church design for the same form of worship in the Protestant Episcopal Church of America, is represented on the walls of the exhibition by a photograph of the well known drawing of his perpendicular church at Cohasset, Mass., but there is no getting over the feeling that this is an imitation, an English importation, planted on foreign soil. Whether this sentiment is reasonable or not, it is strong, and it is such sentiment that influences, or ought to influence the character of architecture, so as to bring it into the necessary harmony with its environment. It is safe therefore to say that the style of church design, which seems good on English soil and does not seem good on American, is good in England and is not in the United States.

The most interesting exhibit is without doubt the French work. French logic goes on where we only speculate, and the Frenchman becomes either a noble example or a shocking one. Even when he becomes a shocking example one cannot but admire the nobility of the spirit that led him to it. As a matter of fact the steel church, which is the text of these remarks (an uncompromising erection in unprotected columns of steel beams, rivetted together, and arched trusses of steel angle bars) bears study well and even grows a little upon the affections by study. It would at any rate inspire respect if not love, while a Chicago architect's church, which is shown both in its steel skeleton and again as a barrel vaulted structure; with coffers, vaulting ribs, arched recesses, and all the rest of it; excites nothing but loathing and boredom. It is dull.

The great interest of the exhibition, is Mr. Challener's decoration for the ceiling of the steamer Montreal, which forms part of the exhibition because Mr. Challener is using the gallery as a studio for this large painting. People who are accustomed to regard pastels as a convenient medium for amateurs, because it lends itself to a fuzzy effect that peculiarly suits a wuzzy manner of execution, should look at Mr. Challener's pastel studies and see that the real forte of pastels is a luminous brightness. The painting from these studies loses nothing in color. The ceiling will be a real work of art. The masses of floating figures—floating between dawn and darkness—form a decorative motive running through the two panels continuously, so as to carry on the idea which is represented by both together. And the figures do float: they form a large composition, are combined in interesting groups and are beautifully modelled, but they float like the irresponsible figures of a dream.

INTERCOMMUNICATION.

[Communications sent to this department must be addressed to the editor with the name and address of the sender attached not necessarily for publication. The editor does not hold himself responsible for the expressions or opinions of correspondents, but will, nevertheless, endeavor to secure correct replies to queries sent in. We do not guarantee answers to all queries neither do we undertake to answer questions in issue following their appearance.]

"H. R.," Fullarton, Ont., writes: You will greatly oblige me by answering the following questions through your paper. (1) Is cement a good thing to put with mortar used for plastering a smoke flue? I have heard cement will not stand fire; is this a fact? (2) What is good to mix with mortar (to be used for plastering a smoke flue), to give a glossy face? (3) Will mortar stain act as a good colouring for cement work?

In answer to the forgoing it may be said, (1) That putting cement in mortar for paving or plastering the inside of a flue, has no special advantages over plastering with well made lime mortor. (2) Cement, under ordinary circumstances will stand heat as well as, all lime mortar. (3) A flue can be made smooth inside by using good lime mortar, and then "trowelling" it well, or floating it until it is quite smooth. Our old fashioned method—and a good one—was to mix cow dung with the mortar and working the whole up into a thick paste and parying the flue with the maise. Flues treated in this manner keep a smooth surface inside for many years. Where fire clay is abundant it is a good plan to coat the flues with it, as it stands heat and remains smooth. One of the best flues is formed by using common glazed drain tiles for the smoke duct, which are built in the chimney. The brick flue, is of course left square inside, and the tiles are cemented at the joints as the work progresses. The angles or voids left, may be used with effect for ventilation purposes. Mortar colors will answer fairly well for the coloring of cements. Any of the mineral colors will answer the purpose, but, in all cases, the introduction of coloring matter, depreciates the strength and durability of the finished cement work.

———

From "Draftsman": In answering my "query" in the October (1902) number of THE CANADIAN ARCHITECT AND BUILDER, you say: "Scale drawings can be reduced by the use of a pantograph." Will you please describe a "pantograph," and tell how to use the instrument?

ANS:—The following, which is taken from "Hodson's Universal Carpenter and Joiner," gives the best description of a pantograph, and the manner of using it, that we can lay hands on at this moment: "By reference to the engraving, Fig. 1, it will be seen that the instrument consists of four parts, resembling rulers jointed together at their extremities, and two sliding carriages, having provision on their under sides for holding a pencil, while they are provided with clamping screws to hold them in their places.

The pieces AB and AC are each two feet four inches long, from the centre of the screw at A, to the extreme end, one-inch wide and one-quarter inch thick. The distances centre AD, AE, FD, FE, are equal, being twelve and a half inches. All the joints of the instrument are made with one-inch screws, and small blocks of hardwood, one-inch by one-inch, by half-inch thick, are glued under each joint to form a good hold for the screws. It is scarcely necessary to say that all these screws should be filed or turned perfectly smooth and round, the ordinary wood-screws being too rough and irregular. The fulcrum B is a leaden weight four inches in diameter, and about one-inch thick, having a wooden stem in it, so that it measures two and a quarter inches from the underside of the lead to the top of the wooden stem. A stout needle or short piece of wire, is driven into the top of the stem for the instrument to turn on. The holes in the piece AB at B, are about half an inch apart, and of such a size as to slip over the wire on the fulcrum easily. The pencil used must be rather a hard one and must be nicely pointed by a file or a piece of sand-paper.

The sliding carriages G and C are made of two pieces of black-walnut or other suitable wood, 2″x1$\frac{1}{4}$″ x$\frac{1}{8}$″ thick, and two pieces $\frac{1}{2}$″x$\frac{1}{4}$″x1$\frac{1}{4}$″ long; the small pieces are glued between the ends of the large pieces so as to make a block, with a hole 1″x$\frac{1}{4}$″ (the size of the rulers) running through it. The pieces AC and DF must now be slightly reduced so as to slide easily, but not too freely, through the holes in the carriages. Two ordinary thread spools with one end of each sawed off square, just where the level ends and the straight part on which the thread is wound, commences. One o

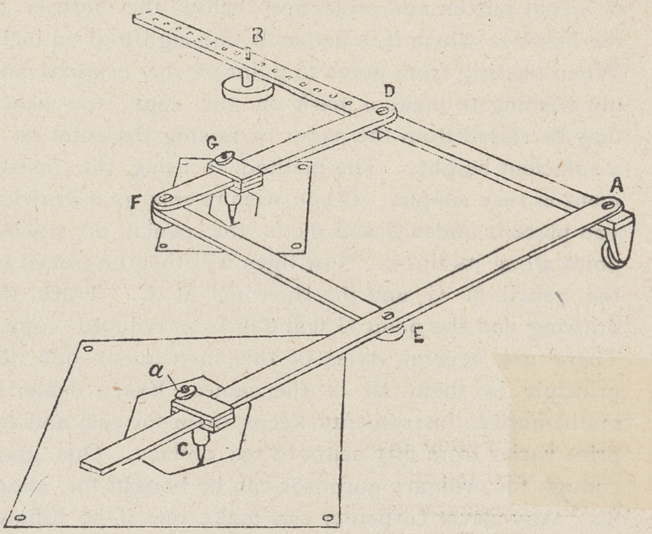
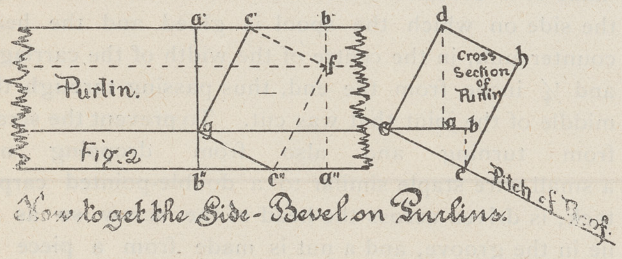


FIG. 1.—PANTAGRAPH.

these spools must now be glued to the centre of one of the thin sides of each carriage, and the opposite side must be cut through one of the joints where it is glued to the $\frac{1}{2}$″x$\frac{1}{4}$″x1$\frac{1}{4}$″ piece, with a thin saw, so that when that end is pinched together it will bind on the ruler, where before it slid easily. The clamping screw is made of a common 1-inch wood-screw, inserted from the side on which the spool is glued, and the head countersunk, in the centre of the width of the carriage, and $\frac{1}{4}$ inche from the end, thus passing through the middle of the joint that was cut. To prevent the screw from turning and also from dropping out a small wire staple similar to a double-pointed carpet tack, is driven across the head of the screw so as to lie in the groove, and a nut is made from a piece of hardwood one inch long by half an inch wide and three-eights thick, cut to an oval shape and slightly rounded on the underside, so as to bind only on the bottom as shown at A. In order to get a good clean thread in the nut, a tap may be made by taking a common screw of the size you are using, and with a saw-file making three or four grooves lengthwise of the thread deepest at the point. To reduce a drawing to one-half of the original, set the instrument so that a hole at B, which is in line with the points of the

pencil at C and G is just as far from G as that point is from C. The pencils should fit tight in the spools by wrapping paper around them, a screw may be inserted to hold them, but it is not necessary. In setting the instrument it is always necessary to have the pencils and the hole in which the fulcrum is placed perfectly in line. For this purpose a piece of wood the size of an ordinary lead pencil about four inches long, with a knitting needle driven into the end, so as to be in line with its centre, is very useful, as by placing it in the carriage at C, and then sighting across the point of the pencil at G to the point in B, they may be adjusted perfectly in line. The distance from B to C represents the original, from B to G the reduced copy ; by varying either any amount of reduction may be made. Instead of two pencils a piece of hardwood the size of a pencil, made sharp at the point may be used with advantage at C, when re-reducing, and in G when enlarging. At A, on the underside of the piece A B, and just beyond the block under the screw, is glued another block 2 1-8 inches long, of the form shown, and at its lower extremity is fastened by a screw, a small wheel, readily made out of a coat button and projecting below the bottom of the block to which it is fastened one-eighth of an inch. When passing from point to point of the original and not wishing to make a mark on the copy, the pencil may be raised from the paper by raising the point at F a sufficient height. The method of using the instrument is very simple. If you wish to enlarge a drawing you place it under G and move the pencil or tracing point along its lines. New lines will then be traced by the pencil at G, and the drawing at C. Trace the drawing and the point G will define a reduced copy." There are several styles of this instrument but the principle in them all is the same. Every dealer in mathematical instruments keeps them for sale and the price varies from fifty cents to ten dollars. One good enough for ordinary purposes can be bought for about $2. Any clever carpenter can make one if he follows the directions given in the foregoing.

From " Carpenter " : I am building a good sized stable and barn combined, and rafters are 28 feet long and I am obliged to put a purlin under them about half way up, and as the roof is "hipped," it will require to have the purlins mitred at the angles. How can I find the lines on the timber to cut this mitred joint ?



ANS.—See Fig. 2 and follow the directions below and you will get the lines desired. Draw C E equal to the pitch of the roof, draw C D perpendicular to C E, and C D, H E equal to a section of the purlin. From D and E draw D A and E B vertical, and from C draw C B horizontal. Now take your purlin and square over two sides as A' B". Make A' C' equal to C A and B" C" equal to C B; connect C' G and C" G. This will give the cuts on the bottom and inside sides. The cuts on top and outside sides may either be obtained with a bevel, as they have the same bevel on opposite sides, or make C' B' equal C B, and C" A" equal C A, from B" and A" square over to F, and connect as shown. The dotted lines are supposed to be on the opposite side of the purlin. This will give the mitre for all equal and different pitches if the building is a rectangular one.

From "Cautious" : Is it better to use a single timber for a girder or bressumner, than to make one or other of built up timbers ?

ANS : Wherever possible, solid timber should be used. Built-up timber—that is timbers which are formed of a number of flat short pieces spiked, bolted or screwed together. In long stretches perhaps built up timbers may have some advantage, as the whole length of timber can be so constructed as to seem all in one length.

From " Stonecutter " : Will you kindly describe (and illustrate) the proper method of laying out a segmental arch and oblige ?

ANS : If our correspondent will carefully follow the

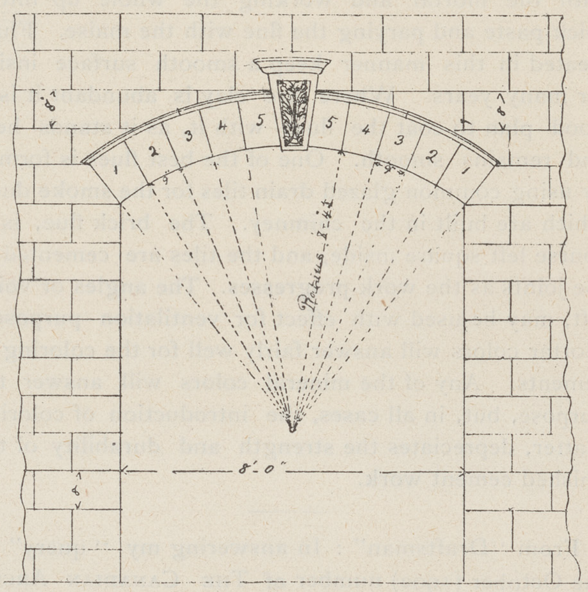


FIG. 3.—LAYING OUT AN ARCH.

sketch,—Fig. 3,—given herewith, he will see how all joints are made or set out. He must also see how the pocket pieces over the arch stones 4 and 5 are made. The lines for the bevels of the stones are obtained from the common centre O, the dotted lines showing the direction of the bevels. Care must be taken to free the the key-stone from the blocks above so as to equally distribute the weight and pressure.

TORONTO BUILDERS' EXCHANGE.

According to the reports presented at the annual meeting held on the 19th inst. the Exchange has enjoyed a prosperous year. the following officers were elected for 1903:—President, Joseph Russell; First Vice-President, R. G. Kirby; Second Vice-President, John Hoidge; Treasurer, David Williams; directors, Messrs. Nelson, Weller, Crang, Martin and Smallwood; Auditors, Messrs. Clay and Holmes; Representative on Technical School Board, J. M. Gander; Representative on Exhibition Board, J. B. Thomson.

The Industrial Publication Co., of New York, have recently issued a second edition of 100 cloth bound pages of Fred. T. Hodgson's book "The Hardwood Finisher," containing rules for preparing wood work for the finisher and for finishing hardwoods, as well as pine and other domestic woods. The price of the book is one dollar.

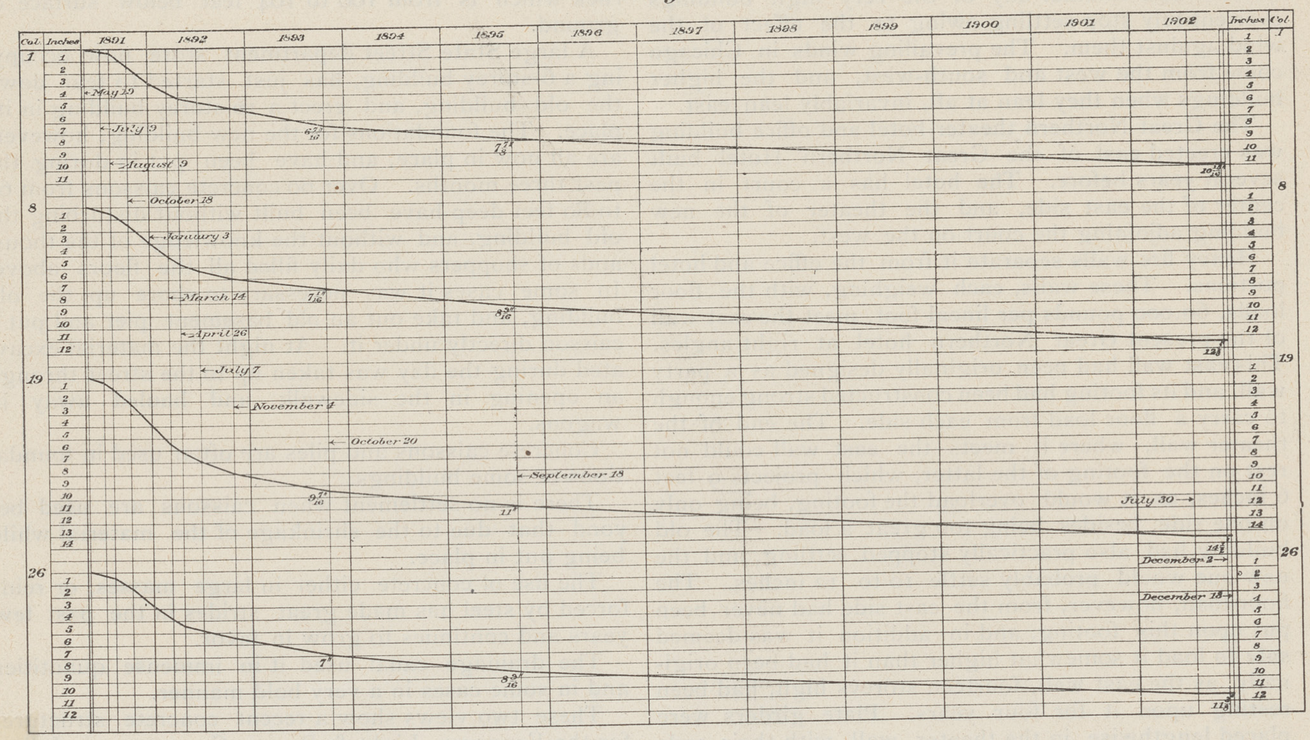
MODERN CONSTRUCTIVE METHODS.*

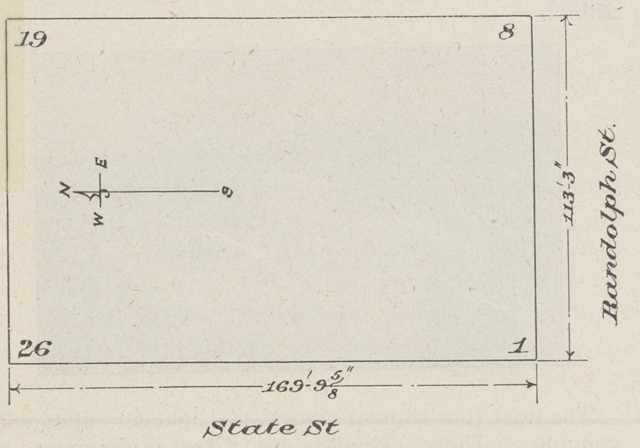
Had I seen Mr. Pearsons remarks delivered at your annual meeting of 1902 before accepting your Registrar's very kind invitation to read a paper at this meeting I greatly fear I would have refused.

At the best it is very embarrassing to a modest engineer, and modesty is the essential characteristic of the engineer, to appear before such a body of men as this. It becomes doubly so, when they have been informed in advance that he belongs to a clique who are using all their wiles and blandishments to seduce the simple-minded and unsuspecting architect into all kinds of nefarious schemes and awful projects.

Mr. Pearson's description reminds you of the Garden of Eden with the poor engineer in the role of the wise and

Levels Showing Settlement of Masonic Temple Chicago.





subtle serpent, and the architect, whom I have always found perfectly able to take care of himself, under any and all circumstances, personating the lovely, but misguided Eve. However, I thank Mr. Pearson for one remark. He says : "For the solution of these problems it was necessary to appeal to the engineer." And he was right. In these strenuous days an Admirable Crichton, or a Lionardo Da Vinci becomes an impossibility. Competition is too keen ; the lines are drawn too closely.

It is not many years ago that the architect felt himself to be, and was, perfectly competent to do any class of work which came to him. Now when he is designing a large office building, or any similar work he not only has to call upon the structural engineer, but the electrical, the mechanical, the sanitary, the heating and ventilating engineers as well.

The architect is at the head, he is responsible for the completed structure, and the designs of the various engineers are only integral parts of the whole, but it is manifestly impossible for one man to know all of the details of the various lines. He may have a smattering of each, but he cannot know, he has not the time to master each and every one. When he tries to do so he fails.

After this somewhat lengthy preamble I will get into the subject matter of my paper.

The most interesting portion of a building to the structural engineer is the foundation.

In Chicago the very compressible soil made unusual care necessary in designing the foundations of the high office buildings.

The soil of Chicago is made ground to a depth of 12 to 14 feet thick, then a layer of hard clay 6 to 10 feet is struck, and upon this layer is placed the spread foundations. Below this layer is a soft clay extending down to a shale formation overlaying the rock, the latter being found at a depth of 80 to 100 feet.

The first high buildings were put on spread, or floating foundations made of steel beams imbedded in concrete. Each foundation was made of such a size that the load coming on the clay would not exceed 3,000 to 3,500 pounds per square foot. This often necessitated putting two or more columns on one foundation.

In figuring load on clay, only dead weight of building is taken into account, as it was found impossible to get a uniform settlement when live load was carried into the footings.

In one large and costly building in Chicago built some years ago after plans by a celebrated Boston architect, the live load was considered in designing the foundations.

The result is that the walls of the building settled very much more than the foundations, carrying the interior columns, and the floors are 6 or 8 inches higher at the center than around the outside. In consequence extra men are stationed on the floors to help the truckmen push the trucks up the incline.

The settlement of the buildings put on spread foundations is from 8 to 20 inches. This is allowed for by putting up the foundations when work is begun,

*Paper read at the annual convention of the Ontario Association of Architects held in Toronto January 13th and 14th, 1903.

The settlement curves of the Masonic Temple 300 ft. high are shown on preceding page.

The first vertical row of figures on the left give the number of the column, the next row the inches of settlement, and the other spaces on the right show the years covered by the observations. You will note that the settlement is not great for about 2 months after foundations were put in place, but as the building went up, and the loads on the footings increased the curve becomes very much sharper. You will also note that the greatest variation in the settlement of the columns occurred at the start when the difference in loads was greater, afterwards the settlement becomes almost uniform, changing at north-east corner when the smoke stack at column 19 was increased in height, causing an increased settlement at this point.

No settlement has taken place in the past 5 months as shown by the horizontal lines. It is, however, questionable whether any of the very high buildings ever entirely stop settling owing to the effect of the wind against them. The prevailing winds in Chicago come from the west and south-west, and the higher buildings when they lean at all, invariably lean east.

The Great Northern theater hotel and office building was erected east of the Great Northern Hotel built several years before. The hotel has a court in the center of the east side, and the theater of the new building adjoining the court on the west.

Heavy fire walls separate it from the office and hotel portions. These walls, each weighing, with the floor loads, 60,000 pounds per lineal foot, meet the east wall of the present Great Northern hotel at right angles. This east wall had been originally designed as a party wall, and its footing had been constructed strong enough to carry a floor load from each side. The end of the theater wall, where it meets the east wall could not rest on the footing of the latter, which projects 9 feet 6 inches, as it would overload the footing, being only on one side, besides being too great a load. The old building had also practically stopped settling, and the new one would probably settle 10 to 12 inches. The floor load, however, from the east side had never been put upon this footing, and in addition it was deemed safe to load it somewhat higher than it had been originally, as the east wall, fourteen storeys high, had been resting upon it for four years. Plate girders were placed lengthwise in the theater wall, with their ends projecting through the old wall, and resting on 36 ton hydraulic jack-screws, which in turn were supported by I beams lying on the footing and parallel to the old wall. The plate girders were of such a length and so located as to transfer to the old footing the desired weight. The screws were raised to their full height, so that they could be lowered 14 inches if necessary. As the new building settled these screws were run down at regular intervals until the settlement stopped. Levels are being taken on the building. After the settlement has entirely ceased the screws will be surrounded with concrete and left.

A rather curious example of foundation exists at Duluth. The Duluth General Electric Company very recently installed a 1,000 k.w. dynamo, and the vibration caused by it affected buildings 500 feet away. The vibration of a 5 storey building over 500 feet away was very perceptible. The building is close to the bay, and I found on examination that the ground is swamp and made ground, down to about 16 feet, where a hard strata is found. This made ground is filled with water and transmits vibrations in waves.

The buildings are built on piles driven into the hard ground, but the top 16 feet are entirely unsupported laterally. One building, however, also about 500 feet away, was found to have no vibration whatever, and it developed that when the foundations of this building were put in the whole area was excavated down to the hard ground and filled with sand to the top of the ground.

In order to avoid the excessive and long continued settlement due to spread foundations, piles were used, and latterly concrete caissons going down to the shale overlaying the rock, or going down to the rock itself are supplanting both. When it is not found feasible to go clear to the rock the caissons are belled out at the bottom, generally to twice the diameter of the caisson itself: that is a 6' caisson is belled out to a diameter of 12 feet on the bottom and the angle of the slope of the bell is about 30 degrees with the vertical. Where the caissons go to rock the belling is not necessary. The caissons are made by digging down from 4 to 6 feet, just as a well is dug, and then lining up the shaft with wooden lagging, the strips vertical, held in place by iron hoops made adjustable. Then another section is excavated and lagging put in, and so on down. When bottom is reached concrete is put in, and lagging removed one section at a time until hole is filled.

One building now being erected will rest on about 90 caissons from 7 to 10 feet in diameter, carried down to rock which is from 100 to 104 feet below surface of ground.

A large State Street department store now occupying a 6-storey building, has just started to tear down the old building, and erect a 16-storey building in its place. The foundations for the new building, however, are all now in place, and have been put in during the past three months. Over 60 concrete caissons from 60 to 80 feet deep have been built without disturbing the old building, and without the knowledge of the thousands of shoppers who daily filled all the floors above. In some cases it was necessary to shore up the old building, and take out an old basement pier and put a caisson directly under it. At night the material excavated during the day was taken up to the street through an opening in the sidewalk, and hauled away in wagons.

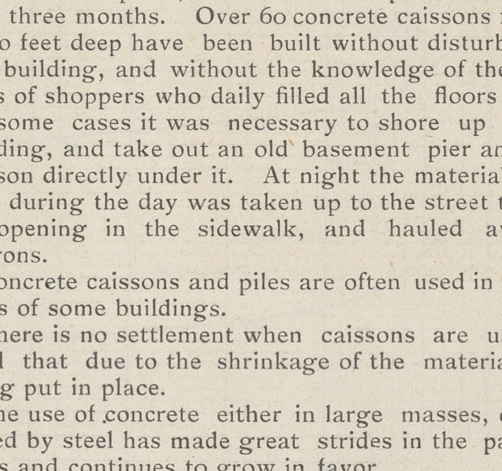
Concrete caissons and piles are often used in foundations of some buildings.

There is no settlement when caissons are used beyond that due to the shrinkage of the material while being put in place.

The use of concrete either in large masses, or reinforced by steel has made great strides in the past few years and continues to grow in favor.

The drainage canal used it in immense quantities and in some cases in a very bold manner.

These two views show a recent concrete structure, for the Economy Light & Power Company at Joliet, Illinois.



The next (not shown) shows steel cylinders filled with concrete. These cylinders are 7 feet in diameter, 52 feet high above the masonry and carry the ends of two 380 feet spans. The masonry piers are only stone on the outside, the stone being 24 to 30 inches thick, and the interior is concrete.

I have here three samples of concrete. Numbers 1 and 2 were taken from foundations of the L.S. & M.S. & C.R.I. & P.R.R.'s at Van Buren Streets which were put in about 31 years ago.

Sample No. 3 is about 8 months old, and is taken from the foundations of the new station now being erected.

The old station was built with limestone walls. When the building was torn down this limestone was put through a crusher, and the concrete of which this sample is made is from the limestone just as it came from the crusher without screening.

FIREPROOFING OF STEEL FRAME.

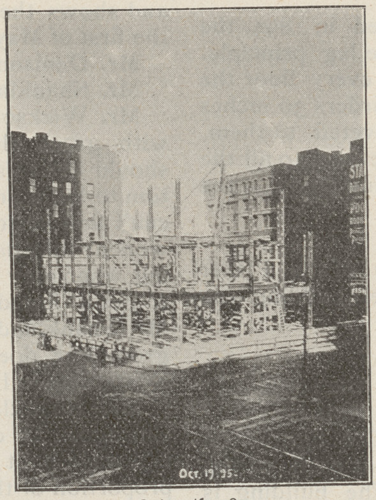
After foundations, next in importance comes the fireproofing of the steel frame of the building.

Concrete floor systems are now being exploited in great variety.

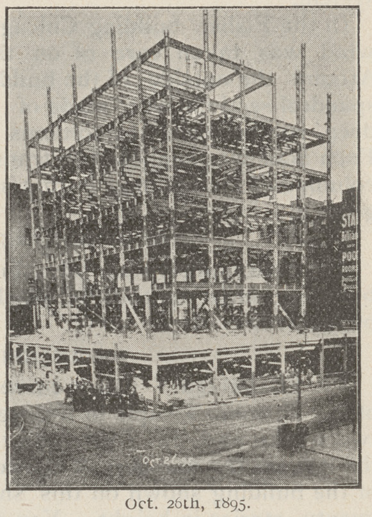
Some of the systems have merit, but all of them make too great claims.

A concrete slab 3 to 4 inches thick, even if reinforced with steel in some form or other, should not be used in a very much greater span than we now use for steel beams with hollow tile arches between. It has beengrtavely told me by a concrete sales agent that in case of fwo 15 in. beams, say 7 ft. span it would be perfectly sae not only to deduct the difference in weight of floor between the 3 in. concrete slab they proposed to use, and the weight of a 15 in. hollow tile arch, but in addition the section can be reduced 25 per cent. on

Oct. 12th, 1895.



Oct. 19th, 1895.



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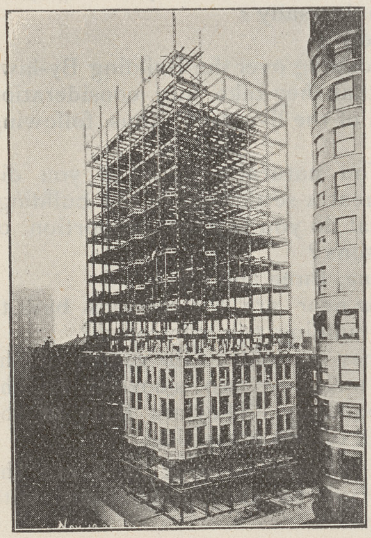

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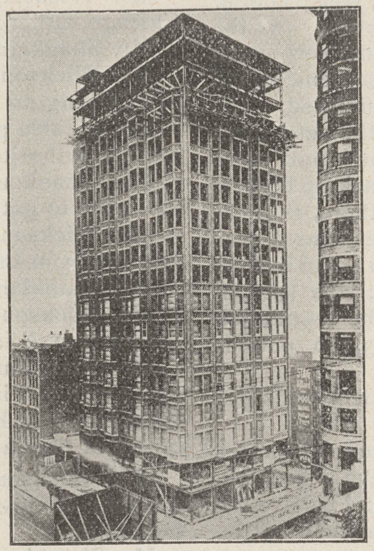
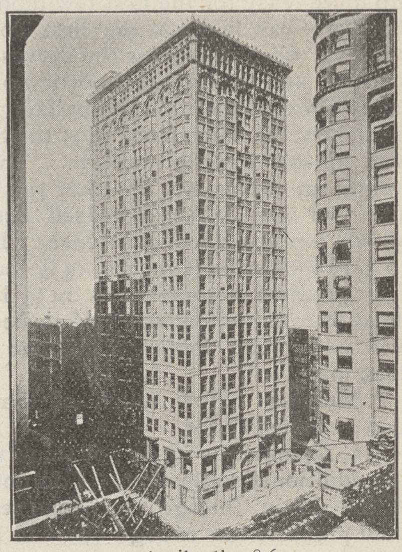


Dec. 12th, 1895.



April 29th, 1896.

account of the help the concrete gives the steel. In other cases they state you can, with concrete, use 17 to 25 foot spans, and save all the steel thereby taken out.

One question, however, they decline to answer. Ask them instead of telling the vertical load it will support without collapsing to turn their slab of concrete 3 in. or 4 in. thick and 17 ft. to 25 ft., span, on edge, and then load it. They invariably decline to test it this way. Now in a 20 or 30 story office building, lateral stiffness in the floors is more essential than carrying capacity. A thin slab of concrete laid on top of 12 or 15 beams cannot by the very nature of things, add to the lateral support of these beams. But a 12 in. or 15 in. hollow tile arch laid in between the beams does make a stiff floor.

Experiments as yet have not demonstrated that concrete floors are fireproof as compared with hollow tile which already has been burned.

While I have faith in concrete and believe it has great possibilities which will be demonstrated in the future, yet I think that now, in order to compete with hollow tile, its advocates are making claims which cannot be substantiated, and in the future they will have to be more conservative not only in their statements, but in their construction in order to succeed.

Recent failures in Jackson, Michigan, where the falling of the floors pulled down the outside walls; and of four floors which collapsed in a $500,000 apartment building in Chicago will undoubtedly prove beneficial in the lessons they teach. Many other failures in concrete floor construction have occurred in the past few years, but these are the most recent.

Another thing, a building is not necessarily fireproof because it has steel floor beams and columns. Naked steel or cast iron is not fireproof. Wood is far preferable, for if it is of sufficient size it chars on the outside, and the charring acts as a protection. Every bit of structural steel must be covered with a fire-resisting material in order to be fireproof.

The last engineering papers give an account of destruction by fire of two English spinning mills, one resulting in the death of nine persons, injury of a large number. The report sums up both disasters as due to the breaking of the cast iron posts, but the same report says the cast iron posts were left bare. In the absence of further information it is only reasonable to suppose that the true cause is that these columns were not fireproofed.

Another and possibly a greater danger than fire is rust. Examination of steel buildings made recently show that the danger is not as great as some alarmists would have us believe, yet it exists.

In a building built in Buffalo in 1895 all the outside columns were filled with cement grout after the brick and fireproofing had been put around them, thus making the whole pier solid monolith with steel core. This

s now being generally followed in the best buildings. While the interior columns do not need this treatment, it is well to fill around them solidly at every floor, because if it does nothing else it will prevent rats and other vermin going from one floor to another. Floor loads: The building ordinances of the different cities cover all cases so completely, that very little is to be said. New York and Chicago both demand 100 pounds per square foot for each floor of an office building, or one to accommodate public gatherings.

WIND BRACING.

A great deal has been written about wind bracing in high buildings, and a great many methods of taking care of wind pressure have been brought forward.

Diagonal rods and portal bracing have been tried, but but interfere too much with floor space, and the former especially can not be carried out and made a perfect system.

In the Fisher building Chicago erected in 1894, the wind was taken care of on the table leg principle. Around the outside of the building at every floor the spandrel sections were made of plate girders 30 inches deep run between the columns and riveted to them. Each floor was supposed to transmit pressure to all the columns of the building in that story, and so on to the ground.

TIME OF CONSTRUCTION.

The views shown on preceding page of the Fisher building show the time in which a steel building can be erected.

DISCUSSION.

Mr. Shankland: These curves shew the settlement of the Masonic Temple in Chicago from 1891 till about two weeks ago, on December 15th. The figures on the left are the numbers of the columns at each corner of the building shown on this sheet. The building is twenty stories in height. You will notice the curves are quite easy for the first few months of construction. The zero was taken at the first construction. As the building becomes older the curves become very much sharper and the greatest portion of the settlement had taken place at the time the building was finished. The first shew the dates from 1895 to 1897; the settlement was almost exactly uniform. Then they put extra weight on corner No. 19; they ran the stack up higher; and you see, in the increased curves there, that the foundation was affected at once. The settlement was 10 5-16 inches, 12⅞ inches, 14½ inches, 11 9-16 inches. The greatest settlement is 14½ inches; the least of those four corners is 10 15-16 inches. The foundation was on spread footings, the load was 3,200 pounds dead load.

A Member: How much of that settlement is live load responsible for.

Mr. Shankland: I do not think the live load causes any additional settlement. I do not believe a building of that size in Chicago ever stops settling; I believe the wind pressure has enough effect to keep a small settlement.

A Member: In that case inside columns would not be affected by the wind.

Mr. Shankland: The building acts as a monolith in that way. From July to December last there is no settlement shown. The levels were taken then. But that is too short a time to place any dependence on. This next photograph shows a work of solid concrete, twenty-six feet high and from six to eight feet on top. This is the Economy Lighting & Power Company of Joliette which is using drainage water to generate power to send to Chicago. That concrete work is not reinforced at all. It is a solid mass of concrete. The next photograph is shewn to illustrate the way concrete is used in bridge piers; those cylinders are seven feet in diameter and fifty-two feet high filled with concrete; the masonry is above high water but it is only a shell of masonry and the interior is all cement concrete. Those piers are 62 feet long and 22 feet high. The concrete is figured to carry the load and the steel only acts as wind bracing.

A Member: Why was not concrete used for the foundations.

Mr. Shankland: It would have been better if they had concrete instead of the natural stone, but the Board of Directors were not willing to allow concrete to be used to that extent. I wanted to use concrete. Piles were driven to the rock; they were sawed off and the building put on top. These next six views simply show the time it takes to construct a steel building. These views are of the Fisher Building eighteen stories high. The first view is on October 12th; the next is one week later, October 19th, and the next on October 26th. And the next is on November 10th, two weeks later.

A Member: Working night and day.

Mr. Shankland: Yes. The next view is taken on December 12, just two months from the time the first picture was taken. The next picture is in the April following and shows the completed building; it was rented from the first of May.

Mr. Denison: It hadn't time to settle.

Mr. Shankland: It was built on piles.

Mr. Wickson: Mr. President, we have all listened with great pleasure to Mr. Shankland's paper. He should live in a civilized place where they have a bottom to build on, not in a place like Chicago where they can't find bottom without going so far down. I do not wonder they have to pay so much attention to fire proofing when they have to go so near the centre of the earth to get a foundation. I want to ask a few questions. Mr. Shankland said that in calculating the load on the ground he does not pay any attention to the live load on the clay. Is that the case in all kinds of soil?

Mr. Shankland: It is the case in everything in Chicago. Of course a factory building or warehouse is always built on piles and there you take in a certain proportion of the live load. But in the spread footing of an office building the live load is not calculated.

Mr. Wickson: That applies more particularly to Chicago rather than universally?

Mr. Shankland: Yes.

Mr. Wickson: In looking over the Building By-laws of Washington I see that they take into consideration a considerable portion of the live load, thus following certain authorities.

Mr. Shankland: You naturally would if you did not want to get too great a settlement in the building.

Mr. Wickson: What do you say the proportion of concrete is in the caissons?

Mr. Shankland: One, three and six.

Mr. Wickson: How near are the caissons built to the party wall in that building you mentioned?

Mr. Shankland: They are built in the centre of the party wall; it is on a street on two sides—it is The First National Bank building. They are built in the centre of the party wall on the other side.

Mr. Wickson: In a case of that kind are the builders allowed to go to the street limit with foundations.

Mr. Shankland: They are allowed to go out to the kerb line.

Mr. Wickson: You have spoken about concrete and its uses; you have also given us some illustrations. Although concrete is being used so much in some respects I have found great difficulty in getting any data when I wanted it for concrete building—I mean the superstructure, not so much the foundation. It is rather a new thing; but still it is being used in some places. Can you give us any way by which we can get data for the strength of the superstructure of a building.

Mr. Shankland: Elsner & Anderson of Cincinnati are trying to get a permit for a sixteen story building. They have not succeeded in getting the permit yet. I do not know how they have figured the concrete. I looked over the plans and, taking the floor load at 100 pounds, and the concrete itself is seven inches thick in the floors, I found they had 83,000 pounds on the basement columns without taking into account the floor itself.

Mr. Wickson : In your address your criticism was largely as to concrete floors.

Mr. Shankland : Concrete floors altogether.

Mr. Wickson : If we take the dictum of a paper called "Fire Proof" we would not use concrete in any shape. It says "During the mediaeval period concrete was extensively used for tombs ; the same is true even unto this day." I suppose we will have to wait for further development in regard to superstructure, in building.

Mr. Shankland : There are going to be great advances made in reinforced concrete in the next few years ; but we do not know yet how they are going to take care of a concrete building.

Mr. Wickson : In your address and also in an article in the last "Brick Builder" there is this clause, "Good Portland cement even in thin layers is an effective preventive of rusting . . . . . . it is of the utmost importance that the steel be clean when bedded in the concrete." It seems to me a great difficulty is getting the steel actually into the building without spots being exposed, even in the handling of the steel, provided it is properly treated at the mills. I suppose in very large buildings they have some way of overcoming that ; but in the ordinary building such as we get in Toronto what is to prevent these places from being exposed to rust ?

Mr. Shankland : We used to give it a coat of oil at the mill and a coat of paint at the job, and a second coat after erection. We do not now paint it at all till after erection. A little red rust won't hurt steel at all; it is the mill scale which if painted over will come off sometime and take the paint with it.

Mr. Wickson : Then if the steel be delivered on the job properly clean, it is quite sufficient to paint it then ?

Mr. Shankland : After erection.

Mr. Wickson : With the use of the wire brush.

Mr. Shankland : That is used after erection. But after two or three months the greater part of the mill scale is off, and what remains is loose enough to be easily scraped off.

Mr. Wickson : In the steel caissons for the concrete bridge piers you showed on the screen, you said the steel work was for bracing against the wind. Would that steel ever rust ?

Mr. Shankland : It has got to be painted outside and is right up against concrete inside and won't rust inside.

Mr. Wickson : It depends on the paint outside.

Mr. Shankland : We investigated a good many buildings in Chicago last spring ; the oldest was about fifteen years old. We cut into the foundations of eight or ten or a dozen of them and we did not find a particle of rust in the foundation. Some places we had to bale the water out when we cut away the concrete. But the blue-black of the mill was on them in every case ; there was not the faintest indication of rust. Steel should not be painted when bedded in concrete.

Mr. Wickson : That leads me to ask another question. The preservation of steel seems to be very complete where it is coated with cement, and I notice in the "Brick Builder" also that there is a statement that the use of hollow porous terra cotta blocks in connection with the cement is now considered to be an excellent method. I did not quite see how they would use them. Was it a matter of entirely coating or casing the steel work with the cement first ?

Mr. Shankland : Plastering against the beam and tile.

Mr. Wickson : The columns would be filled as you mentioned.

Mr. Shankland : Yes.

Mr. Wickson : I am not sure whether it is a fair question to ask you if any of these patent paints so extensively advertised have been found to have special merits.

Mr. Shankland : An architect does not get a chance to see the steel after it is in the building. I have always followed the best bridge engineers' practice in the United States and that means red lead and linseed oil. I have never used any of the patent paints. If architects had a chance to investigate for themselves they might be able to do it ; but, as it is, the only thing is to follow your leader.

Mr. Wickson : Have you ever on any occasion found the beams which are sent out from the mills not sound ? What defects have occurred ? Are they tested at all at the building as they are used.

Mr. Shankland : Only surface inspection. That should be made at the mill.

Mr. Wickson : Is there any other test.

Mr. Shankland : No. There couldn't be any other test. We have an analysis of the steel at the mill; and then the surface inspection is made to see that there are no surface defects.

Mr. Wickson : I ask you that because there were a couple of cases I happened to hear of in which beams collapsed or broke before they were really in place, after they had been delivered at the building.

Mr. Shankland : I do not think that has happened for a few years. When they first started manufacturing steel they got internal strains in the steel. When the market building was in progress they unloaded a beam from a wagon on the street and it split up about six feet. But now they are making so much better steel than they did that it is not dangerous.

Mr. Wickson : Could you give us approximately what the percentage is of extra cost on a building which is made all fire-proof over one that would be well constructed without being fire-proof ?

Mr. Shankland : I could get nearer doing that a year ago than now. In the present conditions of work it would be hard to say. It would run from twenty-five to forty per cent. Steel itself is forty per cent. higher than it was two or three years ago.

Mr. Wickson : There is one other question I wanted to ask you although it hardly comes under your paper ; I am going to ask it for the general use of architects. What are good hand books to use for construction formulae.

Mr. Shankland : The best books are the Carnegie and Pencoyd pocket books.

Mr. A. H. Gregg : What about the various text books ?

Mr. Shankland : I hate to discuss books of that sort in a gathering like this.

Mr. Denison : They are compilations.

Mr. Shankland : That is it. You can't depend on all being reliable. The American Bridge Company is getting out a specification that promises to be very valuable ; it will give floor loads and methods of construction, the building laws of the different cities, and a great deal of data of that kind.

Mr. Wickson : I should like to be the mover of a vote of thanks to Mr. Shankland for his paper.

Mr. Jarvis : Mr. Wickson asked a question with regard to data for figuring the strength of concrete. I do not see why that should not be a very simple thing to get at, by going to the School of Science and having tests made. It is a very simple matter provided we are always sure of the cement ; and that is not a difficult proposition either, so long as you have it tested one week before the time that it is to be put into the works. I am sure that it would be one of the most accurate things in the world do deal with, just as accurate as steel, because it is so very positive ; that is, cement is a positive article to deal with, and so is your crushed stone, if you have them both right. With regard to making beams and columns of concrete, it seems to me that that is also a very simple matter to deal with, having them strengthened with steel rods to increase the tensile strength of the concrete and that it would be a splendid thing for the Association to take up with the School of Science through Prof. Wright. I am satisfied myself that there is nothing in the world equal to cement concrete armoured with steel for almost every kind of building construction which will be better and cheaper than steel. I happened to pick up a paper in Prof. Wright's office a few days ago which told of some engineer reading a paper, to the Society of Engineers

in Cleveland which went as far back as the time that the Pantheon at Rome was built, which has a dome of 142 feet span built entirely of concrete. He says that this has stood the elements for nearly 2,000 years without the slightest weathering ; and that in England, in certain places where the natural stone was used for facing, and concrete was used as a backing, that the natural stone has entirely disappeared and that the concrete, which was intended to play the secondary part, is there as good as the day it was put in. In this paper the engineer says that we are returning with rapid strides back to the old and time honored masonry construction, not of bricks and stone, but of artificial stone, namely concrete armored with steel. I should like to ask Mr. Shankland if an artificial stone composed of Portland cement and crushed stone in proportions of 3 to 1, the stone having the dust removed, would not be absolutely indestructible as to its weathering qualities. I have been studying concrete for the last two years and I do not know anything so fascinating or interesting as science and art in this study ; and it is marvellous how few people seem to understand the first principles of making concrete. I have not seen it myself but I have been told by people who sell the raw material to the city that our engineers won't allow anything smaller for making concrete than what will go through a ¾ inch mesh ; that, after he has got his stone from probably 2 inches to ¾ of an inch, the rest of it is cement and sand; they reject everything smaller than ¾ of an inch. The voids between the ¾ of an inch pieces would be considerable, and the amount of cement necessary to surround the sand which is necessary to fill up these voids would certainly weaken the concrete to a great extent, unless this crushed stone were graded from 2 or 2½ inches down to probably a 10,000th part of an inch, and only dispensing with the dust. If you were to crush the whole of your stone down to the size of an 8th of an inch in order to make a very fine concrete or cement stone for the exterior surfaces of buildings, and you do not want anything larger than an 8th of an inch, there would be a great deal of powder in that. It would be half powder. It would be a powder that would go through a 100th mesh ; that is, 100x100 being 10,000, 10,000 grains would go through to a square inch ; that should be rejected. But if we were to use from 2 inches down to the 10,000th part of an inch, so that there is not any powder left in it at all, and so that there is just enough space left for the cement to surround each particle from the largest down to the 100 mesh, it is something you cannot miss and is the real science of concrete working ; and it seems to me it is just as easy to deal with as steel in figuring out beams and columns. But you have to get your formulae by actual test.

Mr. Burke : I have very great pleasure in seconding the vote of thanks proposed by Mr. Wickson. I would like to ask Mr. Shankland if he has made any examination of the outer columns of buildings cased with half brick or with a thin terra-cotta shell, in the manner so much in vogue a few years ago in Chicago. It seems to me that steel would be more likely to suffer damage by rust in a place like that than in the foundations.

Mr. Shankland : We examined the south-west corner column of the Pontiac building, in the 8th floor, last year. That was built in 1889. The only covering it had was 4 inches of pressed brick on both sides of the corner and fire-proofing inside. There was not a particle of rust to be found, and we opened it up for about 4 feet.

Mr. Burke : Was the brick laid in cement.

Mr. Shankland : Yes ; it is just 4 inches of pressed brick.

Mr. Denison : Do you ever advocate the use of common mortar in a case of that sort.

Mr. Shankland : No, not in high walls or in a skeleton building.

Mr. Denison : Mortar would not have the same effect in protecting the iron as cement.

Mr. Shankland : No ; not lime mortar.

Mr. Pearson : What form of wind bracing do you think best.

Mr. Shankland : That shown in the Fisher Building ; plate girders riveted in between the columns. When the wind strikes the building all the columns in that story go together. The stiffness of that floor will bring into action all the columns in the story.

Mr. Pearson : In treating the expanded metal floor your idea was to treat the floor as a column.

Mr. Shankland : Treat the floor as a stiff plate.

Mr. Pearson : If you take the stories about 12 feet high at 40 pounds wind pressure—that would be about right.

Mr. Shankland : That is very heavy.

Mr. Pearson : Well, taking that pressure, every horizontal foot of wall abutting against the end of a bay of floor would exert a pressure of 480 pounds and the cross section of a 4-inch floor per foot being 48 inches, the pressure would be 10 pounds per square inch.

Mr. Shankland : Well !

Mr. Pearson : Can we get any data or information about that ?

Mr. Shankland : I do not know of any as yet.

Mr. Pearson : Mr. Barrett, of the Expanded Metal Co., is here. We should like to get information on this matter ; it is important. What is the deflection of the floor for the load ? This is a factor in the matter. There are three forces in action, the dead strain, the live load and the lateral pressure, and the vertical loads work against the lateral pressure.

Mr. Shankland : A heavy wind is nothing but a blow; it does not last long nor does it cover an extended area.

Mr. Pearson : I wanted to get at some data in connection with the strength of these expanded metal floors. The manufacturers tell us that 3 inches is ample to do the work, but they give no data and no information ; we must work the thing out ourselves.

Mr. Shankland : What I say is that a concrete slab should not be used in a high building where lateral stiffness is necessary.

Mr. A. H. Gregg : You mean where the wind gets at it.

Mr. Shankland : Yes. For a vertical carrying load it is another matter ; but in a building 280 feet high and 70 feet wide lateral stiffness is very important.

Mr. A. H. Gregg : If you do not have a building over eight or nine stories it does not matter.

Mr. Shankland : Not if the area is corresponding, if the area is great enough.

The President : When you sink long columns into the earth, do you consider the earth at all as an assistance in preventing torsion.

Mr. Shankland : Of course if the clay is stiff enough it will give some lateral stiffness.

The President : Do you rely on it at all ?

Mr. Shankland : No ; neither can we give any figures for a 7 or 10 foot column 100 feet high, we have never tested one except theoretically.

The President : Under a partry wall it might not be possible to insert a column of large diameter. I suppose in that case steel rods would make a small diameter possible.

Mr. Shankland : Yes.

Mr. Baker : We have all listened with great pleasure to Mr. Shankland's instructive lecture. What strikes me particularly in Mr. Shankland's remarks about concrete is the apparent poverty of it compared with what we specify here. Mr. Shankland stated that he specified one, three and six ; in Toronto I think we generally specify about one, two and four or five for building purposes.

Mr. Shankland : We think you are extravagant.

Mr. Baker : I suppose we are ; that is what we want to get away from, and no doubt will when our cements are thoroughly proven. In those bridge piers what load per square foot did you put on the concrete columns.

Mr. Shankland : Twelve tons at the top. In these caissons the ordinary load is 15 tons at the top.

Mr. Baker : I am not clear myself, and I do not know whether we all are in reference to your statement that you do not provide for any live loads in preparing the foundations of the interior columns. Of course 3,000 to 3,500 lbs. per square foot on the ground we would consider extravagant building here ; I think we sometimes go up to 2 or 3 tons. By the dead load do I understand you to mean simply the weight of the floors themselves ?

Mr. Shankland : The weight of the building.

Mr. Baker : The dead weight and lateral thrusts and everything of that kind. You do not include any superimposed load ?

Mr. Shankland : This is only office building construction.

Mr. Baker : Of course if it was only office buildings you referred to the live load is small but you also referred to pushing trucks up an incline and that made me think it was in some warehouse building.

Mr. Shankland : It is a warehouse.

Mr. Baker : I should think there would be tremendous superimposed loads in a building like that.

Mr. Shankland : The outside walls settle very much more than the interior columns. The worst settlement is the walls and you never can counteract the first settlement.

Mr. Baker : Given a floor area of 200 sq. feet and a dead load of 40 lbs.—a superimposed load of 100 lbs.in a 10 storey building would raise the load on the ground from 3500 to 8500 lbs. which in Chicago might be rather high. Mr. Shankland referred to foundations going down 80 or 100 feet in the ground. My attention was drawn to a building in New York, where they are utilizing all that space for offices ; in one case they are putting in eight stories of offices under ground. There is no rdason that I can see why those could not be used.

Mr. Shankland: In New York they excavate in rock. In Chicago it would be a very difficult matter to keep the water from the lake out of the foundations.

The President : Have you examined the Stock Exchange in New York ? They have excavated there some 30 or 40 feet of quicksand, and the seepage in the cellar was nothing when I saw it.

Mr. Shankland : In the Sherry Building they have put in a waterproof caisson and there they started at the surface on one side and had to go down 80 or 90 feet at the other.

Mr. Baker : What is approximately the cost of fire proofed buildings per cubic foot in Chicago.

Mr. Shankland : They run from 35 to 50 cents. That depends on the interior finish. In New York they cost 50 to 75 per cent. more than that on account of the interior finish.

Mr. Duck : I should like to ask Mr. Shankland what method he took to ascertain the proper proportion for concrete, that is of cement, sand and stone.

Mr. Shankland: That has been done several times in the physical laboratories; when we started crushing the limestone for the station they made an investigation of that, and the result of it in the tests was that you could get a stronger concrete to use it as it came from the crusher. All that has since been substantiated by the University of Illinois; and I think Perdue made some tests.

Mr. Duck: Is that in all kinds of stone? How about granite ?

Mr. Shankland: Over at Perdue they used only limestone. I do not know about granite; it would not be so important there; it makes a stronger concrete.

Mr. Duck: The limestone in different localities varies very much. Some of the limestone is almost as fine as impalpable powder. In other sections we get a much better crushed stone.

Mr. Shankland: This limestone comes from Southern Indiana that we use in Chicago.

Mr. Duck: The process of pouring water into a receptacle full of crushed stone to get the amount of sand necessary to fill the interstices; then pouring water into this quantity of sand to get the amount of cement necessary to make a solid mass of the three substances usually comes out one, three and six, in taking a stone such as crushed boulders.

Mr. Jarvis: I should like to ask Mr. Shankland if cement made with a hard crushed limestone that would pass through an 8th sieve and be caught on a 100th, mixed in proportions of three to one, whether the water would have any effect on it so that the whole of the dust is eliminated, and no dust left, only clean particles of crushed limestone that go through an 8th and would be caught by a 100th.

Mr. Shankland: I do not think the water would have any effect on it.

Mr. F.W. Barrett; If I may be allowed to make a remark I should like to do so, as I am interested in reinforced concrete construction. Our business of course, is in expanded metal and concrete, or reinforcing the concrete floor with the mesh of expanded metal. I quite agree with Mr. Shankland on the inadvisability of excessive spans. In a concrete floor, our own practice is to keep down to six to eight feet as long as we are allowed to do it. Sometimes we are forced to make longer spans, but it is against our will. Long spans have to be built with great care. In the instance mentioned by Mr. Shankland, where part of a concrete floor fell in an Apartment House in Chicago, the accident occurred during construction, and was supposed to have been caused by a workman removing the centering while the concrete was green and not thoroughly set. I cannot say that I altogether agree with Mr. Shankland on the lateral strength of the floors; I think if you consider a concrete floor, where the beams are encased in the concrete, although the main slab is just over the top of the beams, each beam is encased in the concrete, so that the concrete slab will form a very very stiff construction across the building from wall to wall; much stiffer than you will find in a floor where the spaces between the steel beams are filled in with separate blocks of terra-cotta. Then of course the consolidation of terra-cotta depends a great deal on the workmanship of the masons that are laying it; for, as you know, bricklayers are apt to leave a great many voids. On the other hand the concrete is laid in a plastic condition, and the beams are incorporated with the slab very largely. The result with the terra-cotta is that in place of a solid construction across the floor you have a number of joints; that is to say, each beam makes a complete separation from the adjoining slab; and if you have any settlement or special extensions or contractions on the part of your building you are going to take away the strength that it has in compression, and such a floor is going to be weaker than a monolithic concrete floor. We have tested concrete floors with our expanded metal construction and while a slab of 3½ inches thick may seem very thin, tests have been made on a slab of 5 feet in width where the joist beams were fastened to girders 12 to 14 feet apart; and on a slab of that construction a partially distributed load of 4,000 pounds to the square foot, and a total distributed load of one hundred and sixteen thousand pounds, was put on that panel, and it did not go through. Mr. Shankland says if you set a slab of concrete up on edge it has not much lateral strength; but I think it has more lateral strength than a slab of terra-cotta of the same size set up on edge; I know that, for I have tried it. We can put up a partition two inches thick and it is a good working partition, but if you put up a terra-cotta partition of double that you can push it over with your foot.

Mr. Denison : It depends upon the foot, doesn't it?

Mr. Barrett : I know we had to rebuild a lot of terra cotta partitions because they fell down in putting other work to them. Then again as to the fire-proof quality of concrete, as compared with terra-cotta blocks, I think Mr. Shankland may perhaps know of a fire in Pittsburg a few years ago in which two buildings were damaged by fire; one fire-proofed with reinforced concrete and the other with terra-cotta blocks ; one building on each

side of the original fire. The building where the reinforced concrete floors were, stood the fire which burned out all the windows, doors and contents of the building on that side, but the floors were intact after the fire, and the repairs were made so quickly that inside of a month the building was reoccupied. The damage was to the superficial parts, the woodwork and that sort of thing. On the other hand the building fireproofed with terra-cotta blocks, on the other side, caught fire and it not only injured the floors but it absolutely destroyed them ; the terra-cotta floors fell down though to the basement.

Mr. Duck : Was that hard tile or porous.

Mr. Barrett : I could not tell you.

Mr. Shankland : You remember that the engineers that reported on those two fires sent in very diverse reports.

Mr. Barrett : Yes; the engineers at that time favored the concrete, and the architects the terra-cotta blocks.

Mr. Shankland : The city I think appointed three experts ; I do not say they had three reports, but they had two.

Mr. Barrett : They had two ; the engineers reported for the concrete, and the architects reported against it. Then the Schiller Theater in Chicago was subjected to a fire test, and the terra-cotta cracked and split and fell off very largely. On the other hand while we cannot recall many buildings giving tests of very severe fires on concrete construction, largely because I suppose the fire protection systems are so complete that they do not have very large fires and they are able to put them out ; but there are no instances where buildings have been very seriously damaged. In Montreal recently there was a building where they had concrete walls, and a great deal of the other parts of the buildings were of wood ; all this wooden construction burned out and subjected the concrete walls to a very hard test. It was a very hot fire, but the concrete stood it all without any damage and it is as perfect now as the day it was built. Tests have been made with small sections of the terra-cotta work and concrete ; they have been subjected to an intense heat and made red hot. Teara-cotta blocks made red hot, then taken out and subjected to cold water will crack and be very seriously damaged ; a cinder concrete block of the same dimensions put into the fire and heated red hot and taken out and subjected to cold water is very little affected.

Mr. Denison : This discussion reminds me of the rival safe agents after the Chicago fire who were calling upon a man who had been burned out. One said, "Do you know that when Jones' building was burned down all his papers were in one of our vaults and, when the fire was out, they opened the safe and what do you think ?" The man said, I don't know ; I suppose you are going to say the papers were intact." The agent said "More than that ; there was a little banty cock in that safe, and when they opened the safe that cock jumped out and crowed." The other fellow says, "That is nothing ; one of our safes was in a bigger fire than that, and when they opened the safe what do you think was in it ?" "I suppose you had a banty cock that crowed too," said the other one. "No, he didn't," said No. 2, "There was a banty cock all right in the safe, but he was frozen stiff."

Mr. Jarvis : I should think that the concrete used for fire protection could not stand at all if it were made with crushed limestone or broken limestone, because the limestone under any great heat would calcine and you would have nothing but lime left. If it were made with crushed quartz or granite or some material of that kind it would be all right, but certainly not limestone.

Mr. Aylsworth : As concrete is used more and more for building walls, the question in my mind is what should be the proper treatment for the outside. I do not like the color of Portland cement and it will be necessary to treat the outside plaster with something. I would like your opinion on the question.

The President : I do not know whether you consider that within your province, Mr. Shankland.

Mr. Shankland : It is out of my line.

The President : If we have heckled Mr. Shankland as much as we can, I would like to put the vote of thanks which I have been asked to put. We are very much obliged to Mr. Shankland for coming here and standing this cross-examination; I think that when our proceedings are printed we shall find that we have got some valuable information, which will be of use to us in our work in the future.

It is moved by Mr. Wickson, seconded by Mr. Burke, that this Association pass a vote of thanks to Mr. Shankland for his kindness.

The vote was carried amid applause.

Mr. Shankland bowed his acknowledgments.

The President : Before the meeting adjourns I believe Mr. Symons has an addition to make to his report as Treasurer.

Mr. Symons : Since reporting to you yesterday in regard to the finances of our Association I have received the total sum of $461.20 that was outstanding for advertising in connection with our papers. This sum, added to that previously reported, makes our balance now in the neighborhood of over a thousand dollars. (Applause.)

It being 1 o'clock p.m. the meeting adjourned for lunch.

STONE WORKING BY MACHINERY.

A correspondent of "The Quarry" agrees with the opinion expressed by that journal that the successful working or otherwise of the wire-saw depends very largely on the constituents of the stone it has to cut, as it will work fairly well in one stone and be a total failure in the next. He says: "I have found these failures arise not only with wire-saws, but with other stone-working tools. I have been concerned lately in some experiments with pneumatically-driven chisels for stone dressing, and found them work well with many stones, but with some hard stones containing much silica they have been a failure. The stones I am alluding to are at present dressed by hand for paving, setts, etc., successfully, but when a pneumatic chisel, making some 1,000 strokes per minute, was used, it was a failure, as up to date I can get no steel to stand it, although I have tried samples from five leading English manufacturers; in all cases it turned up at the edge after a few minutes' use. After some 30 years' experience in this connection, I have come to the conclusion that stone conversion is rather a "tricky" thing, and every stone must be carefully judged on its merits.

FERRO-CONCRETE CONSTRUCTION.

At a recent meeting of the Society of Engineers, Mr. Augustus de Rohan Galbraith read a paper on the Hennebique system of Ferro-concrete construction. The Hennebique principle consists in embedding in concrete straight and cranked iron or steel tension bars and stirrups, to take the shearing stresses, together with distance pieces, the system being applicable to entire buildings from foundation to roof, inclusive. The piles used in the new dock works at Southampton, England, are built up in vertical moulds, in which are placed long steel rods, which give the required strength. These are laced together with wire stirrups, and Portland cement concrete of the best quality is filled into the moulds and rammed round the steel. After a month the pile is taken out of its mould and driven in position, much in the same way as timber piles are. The ram is exceptionally heavy, generally 30 cwt. The head of the pile is protected from injury by covering it with a helmet or iron case filled with sawdust.

The annual average cost of making absolutely necessary repairs to St. Paul's Cathedral, London, is $9,000, and it is estimated that $250,000 is necessary to put it in first-class condition and to make sure it's future.

NOVEL METHOD OF DEALING WITH STRIKES.

When the painters and decorators employed on the residence of Mrs. Herman Oelrichs, New York, fell out with the contractors and struck work, the lady waited a reasonable length of time for a settlement of the trouble, and then notified all concerned that if a settlement was not forthcoming within a week they would have no work there. They failed to come to time, so she employed carpenters and scrub women who worked under her personal direction. They tore down the scaffolds, put the paints and other articles in the street and put the rooms in order. And the painters and decorators are out to the extent of their interest in the work which she planned but has now deferred.

At the St. Louis World's Fair great fluted pillars 36 feet high and 4½ feet in diameter are now being made in a mold set in place, the liquid plaster being poured in at the top. Ordinarily such pillars are made in 24 pieces and set in place, leaving many joints that have to be carefully pointed. There will be 112 such columns on the Textiles Building.

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BUSINESS NOTE.

In this issue will be found the advertisement of the Robert Simpson Co., Limited, Toronto, who make a specialty of carrying out the ideas of architects with reference to interior decoration and fittings. This progressive company can be relied on for the latest designs in carpets, curtains, hangings, as well as furniture. The architects of Canada we are sure will appreciate the assistance which the company are able to give towards the fulfilling of their ideals in the line of interior furnishings. The draperies and floor covers shown by them are strictly high-grade. We bespeak for the Robert Simpson Co. the support of the architects and decorators of Canada.

BUILDERS AS LUMBER DEALERS.

The builders and contractors of Columbus, Ohio, are going to establish a retail lumber yard. They announce that they have become tired of paying the exorbitant prices demanded by lumber dealers and now propose to become bealers themselves.

The American Lumberman comments on this decision as follows: "Let them get their yard well under way and they will learn sundry things. The lesson probably will be a costly one, but there are some people who cannot learn except by experience, and experience is always an efficient. though dear teacher. As they are not lumbermen, though more or less familiar with lumber, they will have to learn about sources of supply, how to chase up delinquent cars, how to estimate the fairy tales offered by lumber salesmen, how to unravel the intricacies of freight rates and rebates, how to get rid of 10,000 feet of lumber that they had to take in order to get the 1,000 feet that they had to have, and many other problems of like nature. They will probably hire a manager and that manager will have to be paid, and they will discover that running expenses and leakage will be fully as large as the personal salary and modest profit of the lumber dealers whom they are trying to supersede."

NOTES.

A new brick manufacturing company has secured possession of a large tract of land in the north-west section of Toronto and will at once commence the erection of a plant. About 100 or more men will be employed.

The Association of Canadian Portland Cement manufacturers has just been formed, the following being the officers: Chairman, J.M. Kilbourn, Lakefield: Vice-Chairman, F.G.B. Allen, Deseronto; Secretary, R. J. Younge; Executive, Messrs. Maitland, McLaughlin, Kilbourn and Kline of Owen Sound, Stanhope of Durham, Knechtel of Hanover, Elliot of Brantford, Morgan of Longue Point, Que., and C. A. Masten of Toronto.

The Plasterers' Section of the Builders' Exchange held their first Annual Dinner December 16th, 1902. An interesting feature of the proceedings was the presentation to their President, Mr. J.M. Gander, of a bronze clock and address. The Section has made great progress in the past year, having met and amicably settled all differences with employees, and are now working with the architects on a glossary of terms defining their work for specification purposes.

BY THE WAY.

Among the restrictions which are being imposed by the city authorities of New York as safeguards against fire is one which prohibits after the beginning of this year the sale and use of parlor matches. Another regulation compels the use of fire-proofed wood in lofty structures, and large quantities of material called by this name have been rejected by the Building Commissioner as worthless.

× × ×

Mr. M. B. Aylsworth, a well-known Toronto architect, has recently returned from Port Arthur and Fort William, where he was engaged for four months in the erection of a hospital and other buildings. He states that building progress in these northern towns is only limited by the difficulty of securing workmen. Bricklayers are being paid $7 per day and labourers $2.50 per day. There are no vacant houses, and not enough mechanics to put up the new ones which the citizens wish to build. Each of the railways will be compelled to build at least one elevator every year for some time to come to provide necessary storage for the rapidly increasing supply of grain.

× × ×

In reply to an English draughtsman's enquiry as to the chances of employment in Canada, the Canadian Emigration Commissioner, in London, Mr. W. T. R. Preston, advised the young man that personal application would be necessary, and that the best time to come to Canada would be in the spring, when other employment could be secured if an opening should not present itself in the line of his usual employment. There never was a better time than the present for efficient architects' assistants to secure employment in Canada, and especially in Toronto. The demand far exceeds the supply, and competent young men in this line from Great Britain arriving here about March or April would be almost certain to secure immediate employment.

× × ×

The congregation of the West Presbyterian Church in New Westminster, B. C., find themselves in serious difficulty as the result of having misplaced their building. The board of managers agreed with the board of managers of St. Andrews' Presbyterian Church, that they would not build nearer than half a mile to that church. It has now transpired that the West Church stands 200 feet nearer St. Andrew's than the specified limit, and the Presbytery has been appealed to by the congregation whose territory has thus been invaded. That body after much debate has allowed the congregation of West Church five months in which to remove their building and thus fulfil their obligation. To do this will cost $1600, and as the church property is heavily mortgaged, this becomes a heavy burden. One is led to wonder what possible injury could result to the complainants from a mistake which placed a sister church 200 feet nearer to them.

"Alas for the rarity
of Christian Charity."

EXPERIMENTS WITH FERRO-CONCRETE.

The London Engineer publishes in abstract the results of some interesting experiments on reinforcing concrete by means of metal by M. Considere. In his earlier work M. Considere endeavoured to rationalise the reinforcement of masses of concrete against tensile strains by means of metal bars ; but his later experiments have been concerned with the question of increasing also the compressive strength of such masses by a suitable distribution of metal. He finds that the most economical method of strengthening a concrete column is to lap it round with wire, metal used in this way being from two and a half to three times as efficient as an equal weight arranged as straight bars parallel to the line of thrust. A number of cylinders 40 millimetres (1·57 in.) in diameter were moulded out of a mixture of 400 kilogrammes (881 lbs.) of cement, with 1 cub. metre (1.31 cub. yds.) of sand, and were wrapped with fine wire, the volume of the latter being 0·034 per cent. of the total volume. These were tested by crushing at different ages, from eight up to one hundred days. Similar specimens without the iron were also moulded and tested, the comparative results obtained being as follows :

Age of specimen, days ..	8	14	22	23	100
Crushing stress, pounds per sq. in. with iron reinforcement	4,846	6,543	7,568	4,935	10,525
Crushing stress, pounds per sq. in. without iron reinforcement	569	711	853	853	2,418

Weight for weight, the hundred-day old re-inforced cylinder is very nearly as strong as iron. In some further experiments the cylinders tested were 15 centimetres (5·90-in.) in diameter, and varied in length from 0·50 metre (19·7-in.) to 1·30 metre (51·1 in. The mixture used was 0·800 cub. metre (1·046 cub. yd.) of gravel, 0·400 cub. metre (·523 cub. yd.) of sand, mixed with, in some cases, 300 kilogrammes (661 lb.) and in others 600 kilogrammes (1,323 lbs.) of cement. The short specimens were tested in the laboratory of the Ecole des Ponts et Chaussees. The block without iron failed at a load of 1,052 lb. per sq. in., whilst another, which was wrapped with a spiral of hard-drawn iron wire ¼-in. in diameter, wound to a pitch of 1·18-in., did not fail till the stress reached 5,120 lb. per sq. in.; and a third, in which the wire used was 0·167 in diameter, wound to a pitch of ·59-in., did not fail under a load equivalent to 5,405 lb. per sq. in., which was the maximum the testing machine was capable of exerting. Another cylinder, in which the bulk of the metal was in the shape of longitudinal bars, failed at a stress of 2,418 lb. per sq. in. M. Considere states that the latter prism, as well as the specimen without iron, both failed suddenly, whilst with the spiral-wound blocks failure was very gradual. It was further noted that in the best of the spiral-wound blocks the amount of compression was considerable, being as much as 3·55 millimetres per metre before any signs of cracking could be observed.

The Board of Health of Ottawa have approved and sent on to the council by-laws to license and regulate plumbers and to regulate the character of plumbing work done in that city.

BUSINESS NOTES.

The Belleville Portland Cement Company has been incorporated with a capital of $2,500,000, and it is reported will erect at Port Ann, near Belleville, Ont., one of the largest cement mills in the world.

A new company, composed of Mr. D. W. Robb and gentlemen composing the Amherst Foundry & Heating Company, is in process of formation at Amherst, Nova Scotia, to manufacture and sell the Robb hot water heater.

The Dennis Wire & Iron Co., of London, Ont., have sent out a card bearing new year greetings, and attached thereto a useful 6 inch celluloid rule, on the reverse side of which are given the weight per foot of iron.

The B. Greening Wire Company, of Hamilton, have as usual issued a most useful and attractive calendar, the date figures being large and discernible at a considerable distance. During last year extensive additions and improvements were made to the company's factory and offices.

The Canadian Revolving Door Company, Limited, having acquired all the patents heretofore owned and controlled by the Van Kannel Revolving Door Co., New York, also the patents heretofore owned by Walter W. Ife on revolving doors, are now being organized with a view of supplying revolving doors of the most approved designs and with latest improvements. Mr. Geo. W. Gaden, of Toronto, who is well-known throughout the Dominion, has been engaged as the company's general manager. The company have improved facilities for manufacturing under the direction of J. W. Hillock & Co., at No. 165 Queen street east, Toronto (which will be the company's headquarters). Three handsome revolving doors are now being made for the King Edward Hotel. Throughout Great Britain, France, Germany, Austria and Russia the revolving doors introduced and operated under the original patents are being recognized as a necessity. Our readers may obtain copies of the company's catalogues by writing the company at the above address and referring to their advertisement in this number.

PEESONAL.

Mr. Thomson, architect, of Sault Ste. Marie, Ont., is about to open a branch at North Bay, Ont.

Mr. Fred. J. Alexander, architect, has accepted an appointment in the Government service at Ottawa.

Mr. J. A. Ellis, architect, has recently removed his offices to the Manning Chambers, City Hall Square, Queen street west, Toronto.

Mr. J. E. Huot, of Montreal, has entered into partnershtp with Mr. Eugene Payette of the same city, formerly connected with Mr. Joseph Venne. The new firm will be known as Huot & Payette with offices in the Bank of Toronto Building, Montreal.

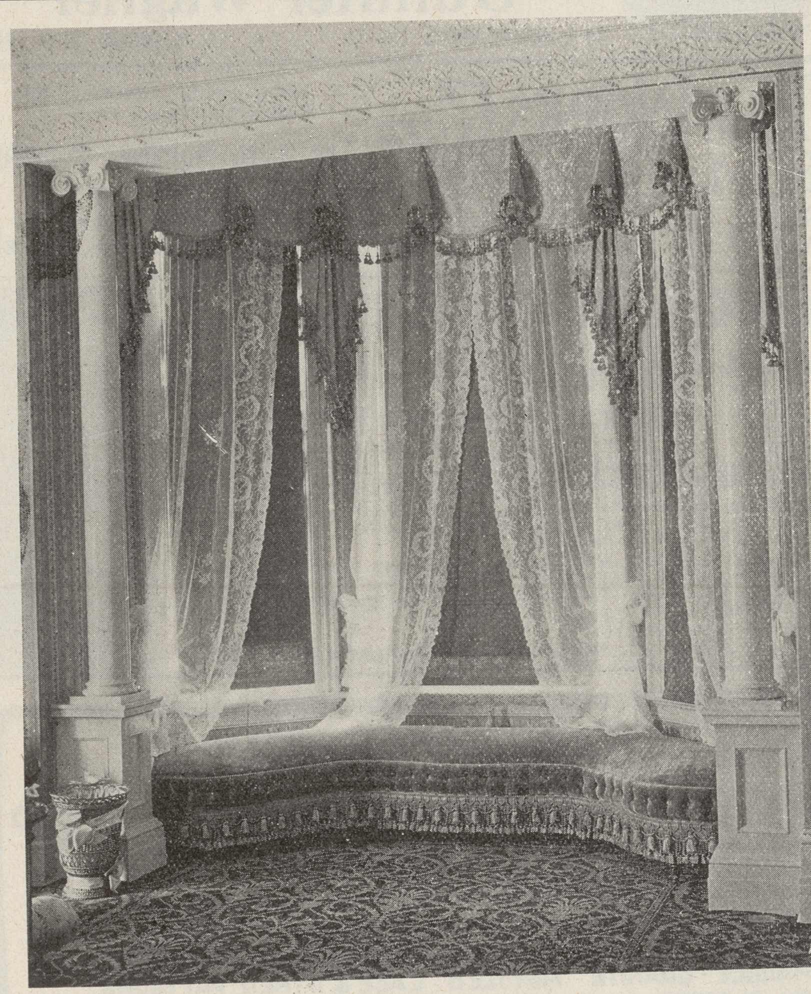
NOTES.

Messrs. Pilkington Bros. have opened a branch warehouse at Vancouver, B. C., in charge of Mr. A. G. Tyne, where a large stock of plate glass will be carried.

The Samson Cordage Works, of Boston, Mass., have recently published a new and attractive catalogue and price list referring to their sash cord and other productions in the cordage line.

The Craftsman is the title of a magazine published monthly at Syracuse, N. Y. Its principal object is to unite the interests of art and labor. Number 4 of Volume 3, now before us, contains excellent reproductions in half tone of artistic pottery, faience fire-places, etc. Prof. Oscar L. Triggs contributes an interesting paper on " A School of Industrial Art."

Mr. G. W. Hill, sculptor, of Montreal, has been declared the winner of the competition for designs for the Soldiers and Strathcona monument to be erected in that city. The memorial, the main feature of which represents a Canadian scout dismounted, his hand on the bridle of a plunging horse, is designed to be about forty feet high, the figures being of colossal proportions and the dimensions of the base of the granite pedestal about 28 by 18 feet. Mr. Hill studied for several years in Paris at the Ecole des Beaux Arts as a pupil of Falgeuire. He returned to Montreal in 1894. The second prize in this competition was awarded to Mr. Andrew T. Taylor, F.R.I.B.A., for a design for a triumphal arch.



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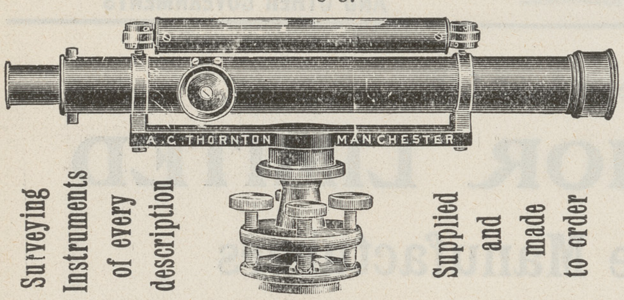

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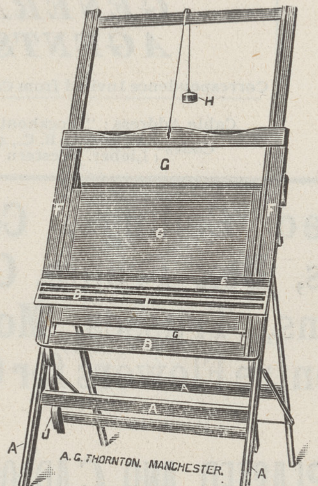

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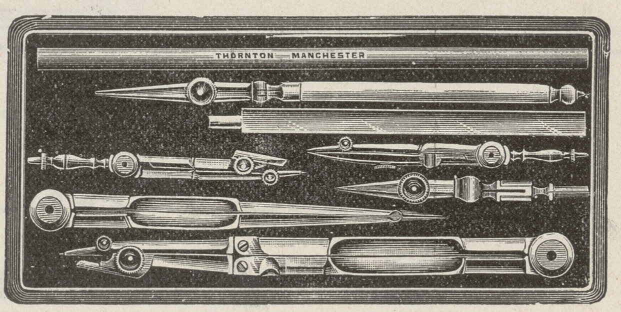

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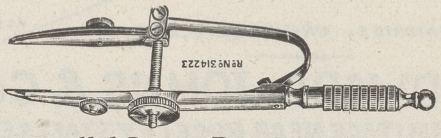

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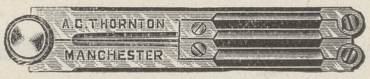

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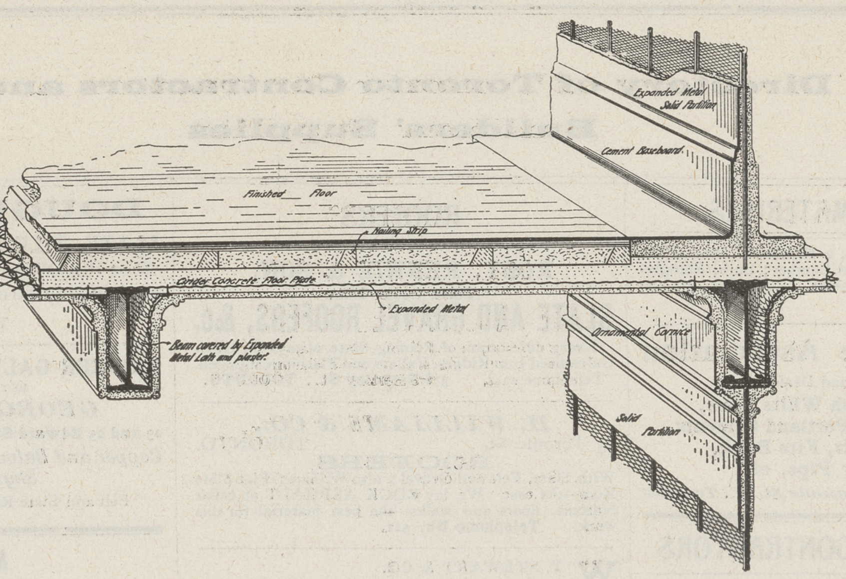

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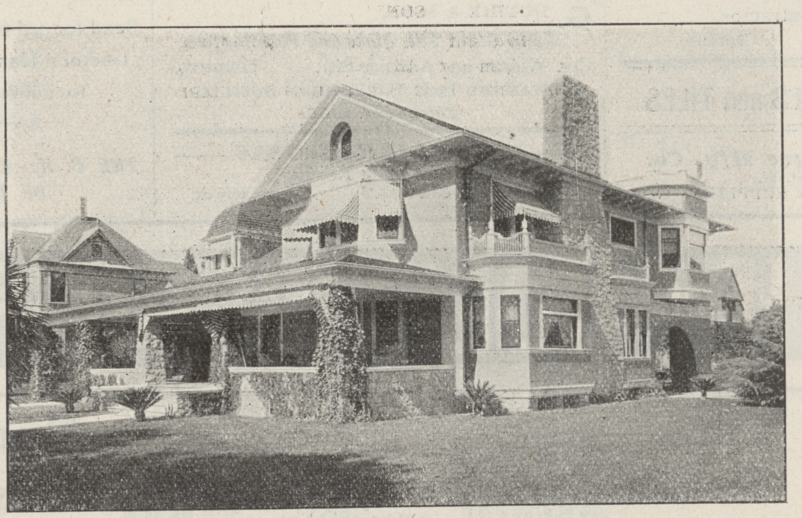

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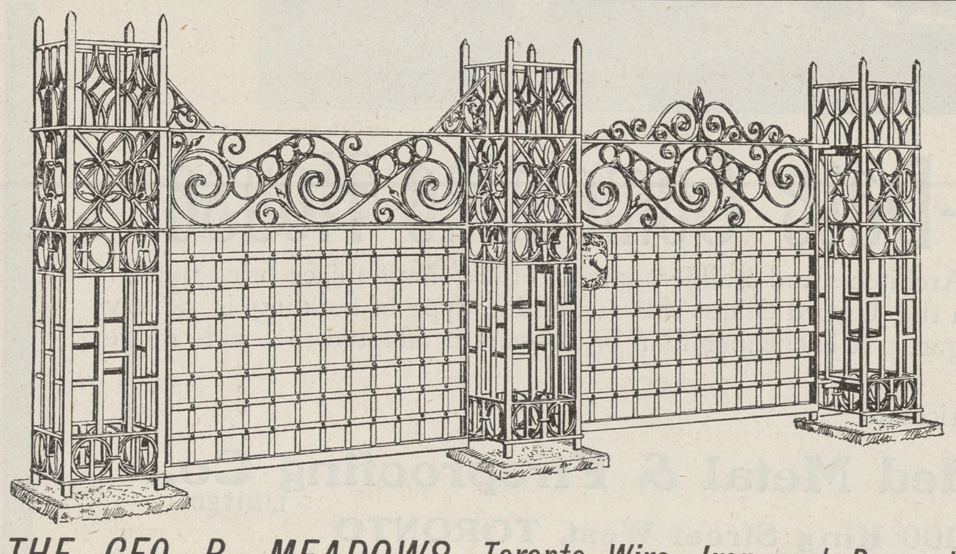

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